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PATENT
Customer No. 22,852
Attorney Docket No. 5725.0771-00

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	)	
	)	
Grégory PLOS et al.	)	Group Art Unit: 1751
	)	
Application No.: 09/668,166	)	Examiner: E. Elhilo
	)	
Filed: September 25, 2000	)	
	)	
For: COMPOSITIONS FOR OXIDATION DYEING OF AT LEAST ONE KERATINOUS FIBRE AND DYEING PROCESSES USING THESE COMPOSITIONS	)	

Commissioner for Patents
Washington, DC 20231

Sir:

TRANSMITTAL OF APPEAL BRIEF (37 C.F.R. 1.192)

Transmitted herewith in triplicate is the APPEAL BRIEF in this application with respect to the Notice of Appeal filed on September 9, 2002.

This application is on behalf of

☐ Small Entity ☒ Large Entity

Pursuant to 37 C.F.R. 1.17(c), the fee for filing the Appeal Brief is:

☐ $160.00 (Small Entity)

☒ $320.00 (Large Entity)

TOTAL FEE DUE:

Appeal Brief Fee	$320.00
Extension Fee (if any)	$0
Total Fee Due	$320.00

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1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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☒ Enclosed is a check for $320.00 to cover the above fees.

PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this Appeal Brief, and such extension has not otherwise been requested, such an extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: October 31, 2002

By: _____
Mark J. Feldstein
Reg. No. 46,693

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FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
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Customer No. 22,852
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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Grégory PLOS et al.	)	Group Art Unit: 1751
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For: COMPOSITIONS FOR OXIDATION DYEING OF AT LEAST ONE KERATINOUS FIBRE AND DYEING PROCESSES USING THESE COMPOSITIONS	)	

Commissioner for Patents
Washington, DC 20231

Sir:

APPEAL BRIEF UNDER 37 C.F.R. § 1.192

In support of the Notice of Appeal filed September 9, 2002, and pursuant to 37 C.F.R. § 1.192, Appellants present in triplicate this brief and enclose herewith a check for the fee of $320.00 required under 37 C.F.R. § 1.17(c).

This appeal is in response to the final rejection dated May 8, 2002, of claims 1-181, which are set forth in the attached Appendix. If any additional fees are required or if the enclosed payment is insufficient, Appellants request that the required fees be charged to Deposit Account No. 06-0916.

I. Real Party In Interest

L'Oréal S.A. is the assignee of record.

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II. Related App als and Interferences

Appellants, Appellants' undersigned legal representative and the assignee know of no other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status Of Claims

Claims 1-181 are pending. No claims have been allowed.

IV. Status Of Amendments

The Amendment After Final filed July 31, 2002, which proposed minor amendments to claim 165, was not entered. However, in a telephonic interview on September 19, 2002, the Examiner agreed to enter the amendments of claim 165 if the proposed amendments are re-filed with this Appeal Brief. Accordingly, a Supplemental Amendment After Final, proposing only the same minor amendments to claim 165 as set forth in the original Amendment After Final, is being filed concurrently herewith. Therefore, since it is Appellants' understanding that the proposed amendments of claim 165 will be entered, claim 165 is shown in the Appendix in its amended form, including the amendments proposed in the Supplemental Amendment After Final.

V. Summary Of Invention

The present invention relates to compositions, particularly ready-to-use compositions, for oxidation dyeing of keratinous fibers, and in particular human keratinous fibers such as the hair, comprising, in a medium suitable for oxidation dyeing, (a) at least one oxidation dye and (b) at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one suitable donor for the at least one enzyme. The at least one enzyme is chosen from 2-electron oxidoreductases, 4-electron

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oxidoreductases and peroxidases, with the proviso that (1) when the at least one enzyme is chosen from 2-electron oxidoreductases, the at least one enzymatic system comprises at least one suitable donor, and (2) when the at least one enzyme is chosen from peroxidases, the at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ. The present invention is also directed to processes using at least one inventive composition. (See claim 1 and specification, pg. 1, ln. 1-14.)

VI. Issues

A. Whether claims 1-179 are indefinite under 35 U.S.C. § 112, second paragraph, for reciting "at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix."

B. Whether claims 1-179 are indefinite under 35 U.S.C. § 112, second paragraph, for reciting "at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ."

C. Whether claim 165, as amended, is indefinite under 35 U.S.C. § 112, second paragraph.

D. Whether claims 1-181 are patentable under 35 U.S.C. § 103 over the Office's hindsight combination of five distinct references.

VII. Grouping Of Claims

Each claim of this patent application is separately patentable, and upon issuance of a patent will be entitled to a separate presumption of validity under 35 U.S.C. § 282. For convenience in handling this Appeal, however, for each ground of rejection the claims rejected on that ground will be grouped in one group. Thus, pursuant to 37 C.F.R. § 1.192(c)(7), in this Appeal, for each ground of rejection the claims rejected on that ground will stand or fall together.

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1300 I Street, NW
Washington, DC 20005
202.408.4000
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VIII. Argument

A. Claims 1-179 are not indefinite under 35 U.S.C. § 112, second paragraph, for reciting "at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix."

Claims 1, 78, 79, 166, 172, 174, 175, and 177 were rejected under 35 U.S.C. § 112, second paragraph, "because the claims recite the limitation 'at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix.'" (Final Office Action, section 6). The remainder of the claims were rejected as dependent on rejected claims. (*Id.*) This rejection is in error, and should be reversed.

The Office contends that "[i]t is unclear whether the sol-gel matrix is present as a separate ingredient in the enzymatic system or it includes the immobilized enzyme." (*Id.*) The Office's confusion, however, is not reasonable, and is not consistent with the view of one skilled in the art. In addition, the rejection based on the Office's confusion is legally and factually erroneous.

As the Board is aware, "[d]etermining whether a claim is indefinite requires an analysis of whether one skilled in the art would understand the bounds of the claim when read in light of the specification." *Credle v. Bond* 30 USPQ2d 1911, 1919 (Fed. Cir. 1994) (citations and quotations omitted). The Federal Circuit has clearly stated that

> [t]he purpose of claims is not to explain the technology or how it works, but to state the legal boundaries of the patent grant. A claim is not "indefinite" simply because it is hard to understand when viewed without benefit of the specification.

S3 Inc. v. nVIDIA Corp., 59 USPQ2d 1745, 1748 (Fed. Cir. 2001). In the present case, the scope of the claims, including the sol-gel matrix, *are* circumscribed with a reasonable degree of clarity and particularity. One skilled in the art would understand the bounds of the claims. That is, the claimed subject matter is not indefinite. This is

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true when the claim is read in isolation, and even more true when the claim is read in view of the specification, as required by the Federal Circuit in, for example, *Credle* and *S3*.

For example, as recited in claim 1, the least one enzymatic system comprises "(i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme," as more specifically set forth in the claims. Thus, even when considered only in isolation it is clear from the claim recitations that the least one enzymatic system comprises at least one sol-gel matrix. Further, since the claims recite that "at least one enzyme [is] immobilized in said at least one sol-gel matrix," it is clear that the sol-gel matrix, as claimed, comprises the at least one enzyme immobilized therein. Accordingly, given these unambiguous recitations, the Office's allegation that "[i]t is unclear whether the sol-gel matrix is present as a separate ingredient in the enzymatic system or it includes the immobilized enzyme" is without merit.

Additionally, the claims must be read in light of the specification. *Credle* at 1919. In the present case, the specification addresses sol-gel matrixes in detail, including the general reaction, which "is a chemical synthesis which can lead to the preparation of gels and transparent glasses from metal oxides." (Specification, pg. 12, ln 19-22, *citing and incorporating by reference* C.J. Brinker and G.W. Scherer, Sol-Gel Science, Academic Press: New York, 1990.) As discussed below, the present specification also provides specific examples of at least one enzyme immobilized in a sol-gel matrix. Especially when the claims are viewed in light of these examples, the Office's allegation of indefiniteness cannot be sustained.

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For instance, Example 1 provides for the preparation of a uricase enzyme immobilized in a sol-gel matrix (Specification, pg. 35, ln. 1-8) and Example 2 provides for the preparation of a laccase enzyme immobilized in a sol-gel matrix. (Specification, pg. 35, lns. 9-16.) Further, Examples 3-6 provide dye compositions comprising either the sol-gel immobilized uricase enzyme of Example 1 or the sol-gel immobilized laccase enzyme of Example 2. (Specification, pg. 36-39.)

There is no ambiguity in the relationship between the enzymes and the sol-gel matrix in these examples. Likewise, there is no ambiguity in defining the at least one enzymatic system as comprising at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix, as more specifically set forth in the claims.

Appellants submit that given the express language of the claims, especially when viewed in light of the specification, the claims reasonably apprise those skilled in the art of the scope of the invention. As explained by the Federal Circuit, "[i]f the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention, Section 112 demands no more." *Miles Laboratories Inc. v. Shandon Inc.*, 27 USPQ2d 1123, 1126 (Fed. Cir. 1993). Notably, except for the Office's confusion and mere allegations, there is no evidence that one skilled would not understand the scope of the claims in view of the specification.[1] The rejection is in error, and should be reversed.

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[1] A rejection, such as the present one, which is not supported by concrete evidence of record or which is supported only by "subjective belief and unknown authority" will be reversed by the Federal Circuit. *In re Sang-Su Lee,* 61 USPQ2d 1430, 1434 (Fed. Cir. 2002); *see also In re Zurko*, 59 USPQ2d 1693 (Fed. Cir. 2001).

B. Claims 1-179 are not indefinite under 35 U.S.C. § 112, second paragraph, for reciting "at least one source of hydrogen peroxide chosen from hydrog n peroxide and at least one enzymatic system which gen rates hydrogen peroxide in situ."

Claims 1, 78, 79, 165, 166, 172, 174, 175, and 177 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for reciting "at least one source of hydrogen peroxide chosen from hydrogen peroxide." (Office Action, section 6.) The remainder of the claims were rejected as dependent on rejected claims. (*Id.*) This rejection is in error, and should be reversed.

The alleged reason of indefiniteness is based on the Office's incomplete quotation from the claims. Thus, not only has the Office failed to consider the recited element in view of the specification as required (see, for example, *Credle,* 30 USPQ2d at 1919; *S3,* 59 USPQ2d at 1748), the Office has not even considered the recited phrase in view of the claims as a whole.

For example, as set forth in claim 1, the "at least one source of hydrogen peroxide [is] chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ... ." (Claim 1, emphasis added.) The underlined portion of this element was omitted from the Office's quotation of the claim. As clearly stated, the source of hydrogen peroxide is chosen from hydrogen peroxide itself and an enzymatic system that generates it. Thus, the recited phrase, when properly read in its complete form, circumscribes the claimed subject matter with a reasonable degree of clarity and particularity, as required. *Miles Laboratories,* 27 USPQ2d at 1126.

Further, the specification explains that

> [a]ll peroxidases suitable for use in the present invention require the presence of hydrogen peroxide. This hydrogen peroxide may be provided in its native form and/or generated

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> in situ via an enzymatic route such as, for example, a 2-electron oxidase and a corresponding donor in the presence of air.

(Specification, pg. 11, ln. 20 - pg. 12, ln. 1.) Once again, when viewed in the context of the specification, there is no reasonable basis for the Office's confusion. Likewise, especially when properly viewed in this context, one skilled in the art would be reasonably apprised of the bounds of the claims.

Nevertheless, it is evident that the Office has still failed to read the subject recitation as it is clearly written, and in light of the specification. For instance, in the Advisory Action the Office further states that "hydrogen peroxide... cannot be generated from it self...." (Advisory Action, pg. 2, ln. 7-8 (emphasis added)). Thus, it appears that the Office reads the claims as reciting that hydrogen peroxide is generated from hydrogen peroxide and an enzymatic source. This view is without support or merit.

As noted above, the subject recitation in its full context is "at least one source of hydrogen peroxide chosen from [1] hydrogen peroxide and [2] at least one enzymatic system which generates hydrogen peroxide in situ." This recitation is analogous (though not identical) to a recitation of "a source of oxygen chosen from (1) oxygen and (2) air (which contains oxygen)." There is no basis for the Office's view, which appears to be "at least one source of hydrogen peroxide generated from (1) hydrogen peroxide and/or (2) an enzymatic source."

Appellants submit that given the express language of the claims, especially when viewed in light of the specification, the claims reasonably apprise those skilled in the art of the scope of the claimed invention. Notably, expect for the Office's confusion and mere allegations that are not supported by reasonable reading of the claims or

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202.408.4000
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specification, there is no evidence that one skilled would not understand the scope of the claims in view of the specification.[1] Accordingly, the rejection is in error and should be reversed.

C. Claim 165, as amended, is not indefinite under 35 U.S.C. § 112, second paragraph.

Claim 165 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for reciting the phrase "at least one suitable." (Final Office Action, pg. 3, ln. 5-6.) Appellants acknowledge the obvious error in this claim, which should read "at least one [suitable] donor for said at least one enzyme."

Based on a telephonic interview with the Examiner on September 19, 2002, Appellants understand that the Examiner will enter the concurrently filed Supplemental Amendment After Final, which corrects the phrase in Claim 165 "at least one suitable for said at least one enzyme" to read --at least one [suitable] donor for said at least one enzyme--, and which corrects the redundant recitation of "further further" to --further--.

Should Appellants' efforts to have the minor amendments of claim 165 entered prior to jurisdiction passing to the Board fail, Appellants respectfully request the Board to exercise its authority under 37 C.F.R. § 1.196(c) and include in the Board decision an explicit statement that claim 165 is allowable in amended form with the correction of the of phrase "at least one suitable for said at least one enzyme" to read --at least one [suitable] donor for said at least one enzyme--, and correction of the redundant recitation of "further further" to --further--.

Accordingly, in view of the proposed amendment to claim 165, Appellants respectfully submit that claim 165 is not indefinite under 35 U.S.C. § 112, second paragraph.

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D. Claims 1-181 are patentabl under 35 U.S.C. § 103 over the Office's hindsight combination of five distinct references.

Claims 1-181 were rejected under 35 U.S.C. § 103(a) as being unpatentable over a combination of five references:

(1) U.S. Patent No. 6,254,646 to De La Mettrie et al. (De La Mettrie), in view of

(2) U.S. Patent No. 5,948,121 to Aaslyng et al. (Aaslyng),

(3) U.S. Patent No. 5,597,386 to Igarashi et al. (Igarashi),

(4) U.S. Patent No. 3,893,803 to Kaiser (Kaiser), and further in view of

(5) U.S. Patent No. 4,961,925 to Tsujino et al. (Tsujino).

The Office has not, however, established, and the five-reference combination does not support, a prima facie case of obviousness.

1. The five cited references, individually and in combination, fail to teach or suggest all the claimed elements, including, *inter alia*, at least one enzymatic system comprising at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix

The Office has asserted and argued that because "all the references disclose methods for dyeing hair and hair dyeing compositions that comprise similar dyeing ingredients," it would have been obvious to combine these compositions to form a composition to be used for the very same purpose. (Final Office Action, section 8.) However, even if such alleged motivation exists (though Appellants do not concede this point), a prima facie case of obviousness has still not been established.

Among other deficiencies, the references, taken individually and/or in combination, do not teach or suggest the "at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix," as more specifically set forth in the claims. That is, as explained further

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below and as admitted on the record by the Office, the references taken individually and in combination do not teach or suggest all the elements of the presently claimed invention.

Specifically, **De La Mettrie**, the primary reference, has not been cited for and does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. In fact, with respect to this deficiency, the Office acknowledged that "[t]he instant claims differ from the [Di La Mettrie] reference by reciting dyeing ingredients such as... enzymes that [are] immobilized in [at least one] sol gel matrix... ." (Office Action dated Nov. 29, 2001, page 5, line 20 to page 6, line 1.)

Aaslyng has only been cited by the Office for teaching "dyeing composition[s] comprising from 0 to 1 mg per mL dyeing composition of microbial laccases." (Office Action dated Nov. 29, 2001, page 6, lines 3-4.) Aaslyng has not been cited for and does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. Accordingly, Aaslyng does not remedy the deficiency of De La Mettrie.

Igarashi does not teach or suggest <u>any</u> components sufficient to remedy the deficiencies of De La Mettrie. Further, Igarashi does not even teach or suggest the components alleged by the Examiner to be clearly taught in Igarashi. As explained further below, Igarashi contributes nothing to the present rejection, and there is no basis for the Office's reliance on Igarashi.

Igarashi was cited by the Office for teaching "hair dyeing composition[s] comprising oxidation precursors such as silane and titanate coupling agents." (Office

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Action dated Nov. 29, 2001, page 6, lines 5-6.) The Office cited Igarashi, col. 8, line 36 to support this position. Although it is not clear exactly how or why Igarashi is being relied upon by the Office, one thing is clear: Igarashi has not been cited for and does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. Accordingly, Igarashi also does not remedy the deficiency of De La Mettrie.

More specifically, although cited by the Office for allegedly teaching "oxidation precursors such as silane and titanate coupling agents," Igarashi does not teach or suggest any oxidation dye precursors. Igarashi also does not teach or suggest a sol-gel matrix. In fact, Igarashi is directed to a dyeing method different from oxidation dyeing according to, for example, De La Mettrie. Specifically, Igarashi discloses "[a] hair dye consisting of an anti-hair antibody immobilized on a high bulky coloring material." (Igarashi, Abstract (emphasis added).) Essentially, Igarashi attaches colored materials to antibodies that have an affinity for hair. (Igarashi, col. 8, lines 21-24.) In order to chemically attach some colored materials to the antibodies, Igarashi teaches that "it is necessary to introduce organic functional groups on the surface of the pigment." (Igarashi, col. 8, lines 31-32 (emphasis added).) To this end, Igarashi relies upon coupling agents that "include silane coupling agents, [and] titanate coupling agents." (Igarashi, col. 8, lines 35-36 (emphasis added).)

Thus, Igarashi discloses coupling agents for attaching colored pigments to antibodies wherein, the coupling agents are attached to the surface of the pigments. Although the coupling agents include silane and titanate coupling agents, the colored pigments are not taught or suggested to be any sort of sol-gel material or matrix.

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Importantly, even if the colored pigment was a sol-gel matrix (though it is not), and even if the coupling agent or the antibody was an enzyme (which it is not), neither the coupling agent nor the antibody of Igarashi is immobilized in the colored pigment. Accordingly, Igarashi clearly does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. In fact, as noted above, Igarashi lacks any disclosure of a sol-gel matrix. Additionally, contrary to its characterization by the Office, Igarashi uses colored pigments attached to antibodies, and Igarashi simply does not teach compositions comprising oxidation dye precursors.

Kaiser was cited by the Office for teaching "hair dyeing composition[s] comprising peroxidases [sic] enzymes suitable for use in conjunction with a peroxide source such as hydrogen peroxide." (Office Action dated Nov. 29, 2001, page 6, lines 7-9.) However, Kaiser has not been cited for and does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. Accordingly, like Aaslyng and Igarashi, Kaiser does not remedy the deficiency of De La Mettrie.

Tsujino was cited by the Office for teaching "hair dyeing composition[s] comprising... enzymes... [and] dyeing composition[s] that comprises immobilized enzymes in order to maintain and stabilize the activity of the enzymes." (Office Action dated Nov. 29, 2001, page 6, lines 10-13.) The Office also asserted that Tsujino "teaches that immobilization method is known in the art, which is used to maintain and stabilize the activity of enzymes." (Final Office Action, pg. 2, ln. 13-15.)

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However, with respect to an enzyme immobilized in a sol-gel matrix these allegations, even if accurate, are all but irrelevant. Tsujino has not been cited for and does not teach or suggest at least one enzyme immobilized in at least one sol-gel matrix, as more specifically set forth in the claims. Tsujino lacks any disclosure of a sol-gel matrix and thus also fails to remedy the deficiency of De La Mettrie. The Office has, in fact, acknowledged that "Tsujino (US '925) does not teach enzyme immobilized in sol-gel matrix... ." (Final Office Action, section 8.)

It is axiomatic that in order to establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the cited references. *Graham v. John Deere Co.*, 383 U.S. 1 (1966). Thus, it necessarily follows from the Office's failure to cite and the references failure to teach or suggest, *inter alia*, "at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix," as more specifically set forth in the claims, that a prima facie case of obviousness has not been established and is not supported by the five-reference combination.

The Office's failure to present evidence of a teaching or suggestion of all the claimed elements is determinative in finding that a prima facie case of obviousness has not been established. For at least this reason, the rejection is in error and should be reversed.

2. The Office has not presented and the references do not contain any evidence of a suggestion or motivation to use a sol-gel matrix in a composition according to the primary reference.

Even if Tsujino does teach enzyme immobilization generally (though Appellants do not concede this to be true), the cited references lack any suggestion of or

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motivation for selecting a sol gel matrix. Such a suggestion or motivation to make the claimed combination must be found in the prior art, not in Appellants' disclosure. See *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Thus, the question is, based on the disclosure of the cited references, why would one select a sol-gel matrix when a sol-gel matrix is never mentioned or contemplated in any way? The answer, based on the disclosure of the cited references, is that one would not have selected a sol-gel matrix for use with a composition according to De La Mettrie. Thus, since the Office has not cited, and the references do not contain, the required suggestion or motivation to support the Office's proposed selection, a *prima facie* case of obviousness has not been established.

The Office's failure to present evidence of a suggestion or motivation to use a sol-gel matrix in a composition according to the primary reference is determinative in finding that a prima facie case of obviousness has not been established.[1] For at least this additional reason, the rejection is in error and should be reversed.

3. There is no motivation to combine the five references; the Office has relied upon hindsight reconstruction in an attempt to reproduce the presently claimed invention.

a. The Office has made only conclusory statements, and has not provided evidence of record for the required motivation to combine.

After discussing the five cited references individually, the Office stated:

> Therefore, in view of the teachings of the secondary references, one having ordinary skill in the art would have been motivated to modify the primary reference by using enzymatic system[s] such as 4-electron oxydoreductase enzymes as oxidizing agents, oxidation bases (precursors) such as silane and titanate compounds and immobilized enzymes to make such a composition.

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(Office Action dated Nov. 29, 2001, page 6, lines 14-17.) However, this is a mere conclusory statement of an alleged motivation. The conclusory allegation of a motivation fails to meet the Federal Circuit's requirement that the record contain "substantial evidence" to support the Office's determinations of *prima facie* obviousness. *See In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001).

Specifically, unless "substantial evidence" found in the record supports the factual determinations central to the issue of patentability, the rejection is improper and should be withdrawn. *See Zurko*, 258 F.3d at 1386. In *Zurko*, the Federal Circuit specifically rejected the Office's reliance on "basic knowledge" and "common sense" to support an obviousness determination when the "assessment of basic knowledge and common sense was not based on any evidence in the record and, therefore, lacks substantial evidence support." *Id.* at 1385. Instead, the Federal Circuit requires "some concrete evidence in the record in support of these findings." *Id.* at 1386. Such concrete evidence is generally lacking from the Office's current argument, and specifically lacking with respect to a motivation to support the proposed five-reference combination.

Moreover, as the Board is aware, the Federal Circuit has subsequently reaffirmed the Office's high burden to establish a prima facie case of obviousness. Specifically, the Federal Circuit held that "[t]he factual inquiry whether to combine references must be thorough and searching. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with." *In re Sang-Su Lee*, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002) (internal quotations and citations omitted). Consistent with *Zurko,* the Federal Circuit held that

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1300 I Street, NW
Washington, DC 20005
202.408.4000
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"[t]he examiner's conclusory statements... do not adequately address the issue of a motivation to combine. This factual question is material to patentability, and could not be resolved on subjective belief and unknown authority." *Id.*

As in *Lee*, the Office's conclusory allegation of a motivation for the proposed five-reference combination is not evidence, and conclusory allegations do not support a *prima facie* case of obviousness. For at least this reason, the rejection is in error and should be reversed.

b. The Office's assertion that the five references all teach analogous compositions that can be combined is factually incorrect and legally unsupported.

The Office argued that:

> Such modification [of De La Mettrie] would be obvious because one would expect that the use of these dyeing ingredients as taught by Ailing [sic], Lagarashi [sic], Kaiser and Tsujino would be similarly useful and applicable to the analogous composition taught by De La mettrie [sic].

(Office Action dated Nov. 29, 2001, page 6, lines 18-20; see also Final Office Action, pg. 4, ln. 14-20.) However, not only is this another conclusory statement that fails to meet the Office's burden as explained by the Federal Circuit in both *Zurko* and *Lee*, the secondary references are not even "analogous [to] composition[s] taught by De La mettrie."

For example, while De La Mettrie is directed to oxidizing compositions for use on keratin fibers, Igarashi is directed to colored species attached to antibodies. The Office has not shown, and the references do not contain, any basis for the Office's assertion that Igarashi's antibody-based compositions are "analogous [to the oxidation dye] composition[s] taught by De La Mettrie."

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Thus, since the factual premise relied upon by the Office is objectively false, the Office's conclusion of a motivation to combine based thereon is unsupported and equally incorrect. For at least this reason, the rejection is in error and should be reversed.

c. The Office's allegation that it is prima facie obvious to combine the disclosures of five distinct references is legally incorrect and wholly unreasonable.

The Office argued that:

> it is prima facie obvious to combine two or three compositions each of which is taught by [the] prior art to be useful for [the] same purpose in order to form third or forth composition that is to be used for [the] very same purpose, idea of combining them flows logically from their having [been] individually taught in [the] prior art. (In re Kerkhoven 205 USPQ 1069 [(CCPA 1980)]).

(Office Action dated Nov. 29, 2001, page 6, line 20 to page 7, line 2.) Although the Office states that it would have been obvious "to combine two or three compositions," the Office makes no attempt to identify the "two or three compositions." In fact, rather than combining "two or three" compositions, the Office is suggesting the combination of five references: (1) De La Mettrie, (2) Aaslyng, (3) Igarashi, (4) Kaiser, and (5) Tsujino. However, at most, *Kerkhoven* says that "[i]t is prima facie obvious to combine two compositions...." *Kerkhoven* at 1072 (*emphasis added*). Thus, the Office's reliance on *Kerkhoven* is misplaced. There is simply no support for the novel position asserted by the Office that combining three compositions is *prima facie* obvious, let alone for the Office's actual proposal to combine five references.

Likewise, rather than forming "third or forth" compositions, the Office is suggesting the combination of the five references to form a sixth completely novel

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1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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composition. Once again, since *Kerkhoven* refers only to combining two compositions "in order to form a third composition which is to be used for the very same purpose," there is simply no support for the novel position asserted by the Office that forming a fourth composition would have been *prima facie* obvious, let alone for the Office's actual proposal to form a sixth novel composition. *Id.*

Finally, the Office argues that:

> Furthermore, combination for [the] same purpose, of one additive explicitly disclosed in prior art and another suggested by prior art is at least prima facie obvious (In re Susi 169 USPQ 423).

(Office Action dated Nov. 29, 2001, page 7, lines 2-4.) It is not clear from the Office Action what, if anything, is being referenced by "one additive explicitly disclosed in prior art" and by "another suggested by prior art." Moreover, the statement regarding "combination" seems unrelated to and does not support the Office's proposal to "modify the primary reference by using enzymatic systems such as 4-electron oxydoreductase enzymes as oxidizing agents, oxidation bases (precursors) such as silane and titanate compounds and immobilized enzymes to make such a composition." (Office Action dated Nov. 29, 2001, page 6, lines 14-17.)

Further, under the theory implicit in the Office's reliance on *Kerkhoven* and *Susi*, all combinations of known hair dye components are prima facie obvious. However, the invalidity of this position has been recognized in countless Supreme Court and Federal Circuit decisions. *See, e.g., Graham v. John Deere Co.,* 383 U.S. 1 (1966); *United States v. Adams*, 383 U.S. 39 (1966); *In re Kotzab,* 55 USPQ2d 1313, 1316 (Fed. Cir. 2000) ("Most if not all inventions arise from a combination of old elements... identification in the prior art of each individual part claimed is insufficient to defeat

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patentability of the whole claimed invention." (citations omitted)); *In re Rouffet*, 47 USPQ 2d 1453 (Fed. Cir. 1998); *Custom Accessories Inc. v. Jeffrey-Allan Ind. Inc.*, 1 USPQ2d 1196, 1198-1199 (Fed. Cir. 1986) ("A traditional problem with focusing on a patent as a 'combination of old elements' is the attendant notion that patentability is undeserving without some 'synergistic' or 'different' effect... Though synergism is relevant when present, its absence has no place in evaluating the evidence on obviousness." (footnotes and quotations omitted).). The theory of the present rejection is exactly the misdirected logic that is prohibited by the courts with respect to the combination of known components. *See, e.g., Fromson v. Advance Offset Plate, Inc.* 225 USPQ 25, 31 (Fed. Cir. 1985) ("There is no basis in the law... for treating combinations of old elements differently in determining patentability.").

In particular, the premise of the present rejection, *i.e.*, that it is prima facie obvious to combine known components, is especially inapplicable for reactive oxidation dye components.[2] When there is a functional relationship between components, the law is clear for a novel combination: it is not prima facie obvious to combine known components. *Adams*, 338 U.S. at 50. In *Adams*, for example, the claimed invention was a wet battery with magnesium and cuprous chloride electrodes. *Id.* at 42. The prior art showed wet batteries with zinc and silver chloride electrodes, and that zinc and silver chloride may be substituted with magnesium and cuprous chloride, respectively.

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[2] De la Mettrie explains that their compositions are based on chemically reactive components. For example, according to De la Mettrie "[o]xidation dye precursors, or oxidation bases, are colourless or weakly coloured compounds which, when combined with oxidizing products, can give rise to coloured compounds and dyes by process of oxidative condensation." (De la Mettrie, col. 1, ln. pg. 16-20.).

Id. at 48. Based such a substitution, it was argued that the claimed battery was obvious. *Id.*

The Supreme Court, however, found this position to be flawed. *Id.* They distinguished *Sinclair & Carroll Co. v. Interchemical Corp.* 325 U.S. 327 (1945), where the substitution of an inert component for an equivalent component was held to be obvious, based on the fact that in *Adams* "the [claimed] battery is shown to embrace [known] elements having an interdependent functional relationship." *Adams*, 338 U.S. at 49-50 (emphasis added). Specifically, they held that "[i]t begs the question... to state merely that... [the elements] were individually known battery components [and therefore obvious]. If such a combination is novel, the issue is whether bringing them together as taught by [the applicant] was obvious in the light of the prior art." *Id.* at 50.

The emphasis in *Adams* on functional relationships between components explains why *Kerkhoven* is factually distinct from the present case, and why the Office's reliance on *Kerkhoven* is misplaced. Specifically, unlike *Adams*, in *Kerkhoven* the applicant claimed a process for preparing a detergent composition comprising merely mixing one anionic and one cationic detergent. *Kerkhoven*, 205 USPQ at 1070. Also unlike *Adams* as well as the present facts, there was no functional or chemically reactive relationship between the components in the *Kerkhoven* process of mixing anionic and cationic detergents. In contrast, in De La Mettrie and, for example, Aaslyng, the components of the dye composition chemically interact to polymerize by oxidation and to form colored compounds. Given this functional interrelationship, a combination of De La Mettrie with any or all of the secondary references is not prima facie obvious; *Kerkhoven* is not applicable.

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The Office's premise that a novel composition of old, chemically reactive components is prima facie obvious, based on combination of compositions, cannot be sustained.

IX. Conclusion

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this Appeal Brief, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

Dated: October 31, 2002

By: _____
Mark J. Feldstein
Reg. No. 46,693

Post Office Address (to which correspondence is to be sent)

Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.
1300 I Street, N.W.
Washington, D.C. 20005
(202) 408-4000

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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App ndix - Claims On Appeal

1. (Amended) A composition for the oxidation dyeing of keratinous fibres comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases;

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme, and

with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ,

in a medium suitable for said oxidation dyeing.

2. A composition according to Claim 1, wherein said keratinous fibres are human keratinous fibres.

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3. A composition according to Claim 2, wherein said human keratinous fibres are hair.

4. A composition according to Claim 1, wherein said composition is a ready-to-use composition.

5. A composition according to Claim 1, wherein said at least one oxidation dye and said at least one enzymatic system are immobilized in the at least one sol-gel matrix.

6. A composition according to Claim 1, wherein said at least one enzyme is chosen from 4-electron oxidoreductases and said at least one enzyme is combined with said at least one oxidation dye.

7. A composition according to Claim 1, wherein said sol-gel matrix is derived from at least one sol-gel reaction of at least one precursor at a temperature suitable for said at least one sol-gel reaction, said at least one sol-gel reaction comprising (i) at least one hydrolysis reaction chosen from partial and total, acidic and basic hydrolysis reactions, and (ii) at least one condensation reaction.

8. A composition according to Claim 7, wherein said temperature suitable for said at least one sol-gel reaction ranges from about 10°C to about 85°C.

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9. A composition according to Claim 8, wherein said temperature suitable for said at least one sol-gel reaction ranges from about 20°C to about 40°C.

10. A composition according to Claim 7, wherein said at least one precursor is chosen from metallic precursors, wherein said metallic precursors are chosen from:

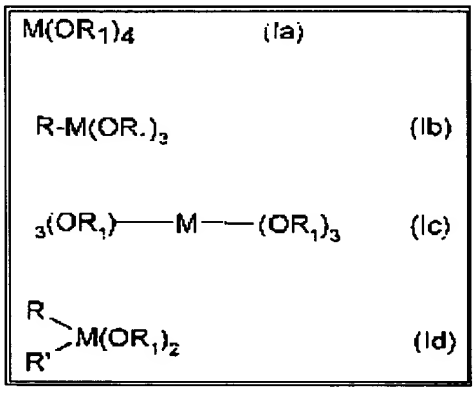
(i) oxides of transition metals, wherein said oxides of transition metals are chosen from oxides of transition metals of groups 1b to 7b of the Periodic Table, oxides of transition metals of group 8 and oxides of transition metals of the Lanthanide group of the Periodic Table;

(ii) aluminum oxides, boron oxides, silicon oxides and tin oxides; and

(iii) aluminum phosphates.

11. A composition according to Claim 7, wherein said at least one precursor is chosen from organometallic precursors wherein said organometallic precursors are chosen from:

(1) silanes, titanates, and zirconates of formulae (Ia), (Ib), (Ic) and (Id):



wherein:

- M is chosen from silicon cations, titanium cations and zirconium cations;

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- R_1 is chosen from linear and branched alkyl groups;

- R and R', which may be identical or different, are each chosen from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said groups may optionally be substituted with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

(2) chelated titanates of formula (II) and chelated zirconates of formula (II):

$$N(OR_1)_n(X)_x \qquad (II)$$

wherein:

- N is chosen from Ti^{a+} and Zr^{a+},

wherein:

- a is chosen from 4 and 6;

- X, which may be identical or different, are each chosen from chelating groups,

wherein:

- the degree of complexation of said chelating groups with said N is b;

wherein:

- b is chosen from 2 and 3;

- R_1, which may be identical or different, are each chosen from linear and branched alkyl groups;

- x is 1 or 2; and

- n is equal to (a-bx) with the proviso that n is greater than or equal to 1; and

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(3) chelated titanates of formulae (IIIa), (IIIb) and (IIIc) and chelated zirconates of formulae (IIIa), (IIIb) and (IIIc):

$$R\text{-}N(OR_1)_m(X)_t \quad \text{(IIIa)}$$

$$(X)_t(R_1O)_mN\text{-}\ R''\text{-}N(OR_1)_m(X)_t \quad \text{(IIIb)}$$

$$(R)(R')N(OR_1)_p(X)_t \quad \text{(IIIc)}$$

wherein:

- N is chosen from Ti^{a+} and Zr^{a+}, wherein a is chosen from 4 and 6;

- X, which may be identical or different, are each chosen from chelating groups,

wherein:

- the degree of complexation of said chelating groups with said N is b, wherein b is chosen from 2 and 3;

- R_1, which may be identical or different, are each chosen from linear and branched alkyl groups;

- R and R', which may be identical or different, are each chosen from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said groups may optionally be substituted with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

- R" is a divalent group derived from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said divalent group may optionally be substituted with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

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- t is chosen from 1 and 2, except in IIIc, t may only be 1;

- m is equal to (a-bt-1), with the proviso that m is greater than or equal to 1; and

- p is equal to (a-bt-2), with the proviso that p is greater than or equal to 1.

12. A composition according to Claim 11, wherein said R_1 is chosen from linear and branched C_1-C_4 alkyl groups.

13. A composition according to Claim 11, wherein said chelating groups are chosen from carboxylic acids, β-ketones, β-diketones, β-keto esters, β-keto amines, α-hydroxy acids, β-hydroxy acids, amino acids, salicylic acid and derivatives of any of the foregoing.

14. A composition according to Claim 13, wherein said chelating groups are chosen from acetoacetoxyethyl methacrylate, methyl α-hydroxymethacrylate, ϵ-N-methacryloyl-L-lysine, 4- ethacrylaminosalicylic acid and 5-methacrylaminosalicylic acid.

15. A composition according to Claim 7, wherein said at least one precursor is chosen from tetraalkoxysilanes, alkyltrialkoxysilanes and aminoalkyltrialkoxysilanes.

16. A composition according to Claim 7, wherein said at least one sol-gel matrix further comprises at least one additional optionally functionalized polymer.

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17. A composition according to Claim 16, wherein said at least one sol-gel matrix comprises at least one polymer network, chosen from partially crosslinked polymer networks and totally crosslinked polymer networks, derived from said at least one sol-gel reaction of said at least one precursor and at least one additional optionally functionalized polymer.

18. A composition according to Claim 17, wherein said at least one additional optionally functionalized polymer is chosen from polymers derived from radical polymerization of at least one monomer and polymers derived from polycondensation of at least one monomer.

19. A composition according to Claim 1, wherein said 2-electron oxidoreductases, which may be identical or different, are each chosen from pyranose oxidases, glucose oxidases, glycerol oxidases, lactate oxidases, pyruvate oxidases, uricases, choline oxidases, sarcosine oxidases, bilirubin oxidases and amino acid oxidases.

20. A composition according to Claim 19, wherein said uricases are chosen from uricases of animal origin, microbial origin and those uricases derived from biotechnology.

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21. A composition according to Claim 19, wherein said uricases are chosen from uricases extracted from boar's liver, uricases derived from Arthrobacter globiformis and uricases derived from Aspergillus flavus.

22. A composition according to Claim 1, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 0.01% to about 20% by weight relative to the total weight of said composition.

23. A composition according to Claim 22, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 0.1% to about 10% by weight relative to the total weight of said composition.

24. A composition according to Claim 1, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 10 U to about 10^8 U units per 100 g of dye composition.

25. A composition according Claim 1, wherein said 4-electron oxidoreductases, which may be identical or different, are chosen from laccases, tyrosinases, catechol oxidases, deamino oxidases and polyphenol oxidases.

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26. A composition according to Claim 25, wherein said 4-electron oxidoreductases, which may be identical or different, are each chosen from laccases of plant origin, animal origin, fungal origin and bacterial origin and laccases obtained by biotechnology.

27. A composition according to Claim 26, wherein said laccases are chosen from those produced by plants performing chlorophyll synthesis.

28. A composition according to Claim 26, wherein said laccases are chosen any of the laccases which may be extracted from Anacardiacea, Podocarpacea, Rosmarinus off., Solanum tuberosum, Iris sp., Coffea sp., Daucus carrota, Vinca minor, Persea americana, Catharanthus roseus, Musa sp., Malus pumila, Gingko biloba, Monotropa hypopithys , Aesculus sp., Acer pseudoplatanus, Prunus persica and Pistacia palaestina.

29. A composition according to Claim 26, wherein said laccases are chosen from those of fungal origin and those obtained by biotechnology.

30. A composition according to Claim 29, wherein said laccases are chosen from Polyporus versicolor, Rhizoctonia praticola, Rhus vernicifera, Scytalidium, Polyporus pinsitus, Myceliophthora thermophila, Rhizoctonia solani, Pyricularia orizae, Trametes versicolor, Fomes fomentarius, Chaetomium thermophile, Neurospora crassa, Colorius versicol, Botrytis cinerea, Rigidoporus lignosus, Phellinus noxius, Pleurotus

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ostreatus, Aspergillus nidulans, Podospora anserina, Agaricus bisporus, Ganoderma lucidum, Glomerella cingulata, Lactarius piperatus, Russula delica, Heterobasidion annosum, Thelephora terrestris, Cladosporium cladosporioides, Cerrena unicolor, Coriolus hirsutus, Ceriporiopsis subvermispora, Coprinus cinereus, Panaeolus papilionaceus, Panaeolus sphinctrinus, Schizophyllum commune, Dichomitius squalens and variants of any of the foregoing.

31. A composition according to Claim 26, wherein said laccases are present in said composition in an amount ranging from about 0.5 lacu to about 2000 lacu units per 100 g of said composition.

32. A composition according to Claim 26, wherein said laccases are present in said composition in an amount ranging from about 10,000 U to about $4x10^7$ U units per 100 g of said composition.

33. A composition according to Claim 26, wherein said laccases are present in said composition in an amount ranging from about 20 ulac to about $2x10^6$ ulac units per 100 g of said composition.

34. A composition according to Claim 1, wherein said 4-electron oxidoreductases are present in said composition in an amount ranging from about 0.01% to about 20% by weight relative to the total weight of said composition.

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35. A composition according to Claim 34, wherein said 4-electron oxidoreductases are present in said composition in an amount ranging from about 0.1% to about 10% by weight relative to the total weight of said composition.

36. A composition according Claim 1, wherein said peroxidases, which may be identical or different, are each chosen from NADH peroxidases, fatty acid peroxidases, NADPH peroxidases, cytochrome-c peroxidases, iodide peroxidases, chloride peroxidases, L-ascorbate peroxidases and glutathione peroxidases.

37. A composition according to Claim 1, wherein said peroxidases, which may be identical or different, are each chosen from simplex peroxidases and catalases.

38. A composition according Claim 37, wherein said peroxidases, which may be identical or different, are each chosen from simplex peroxidases.

39. A composition according Claim 1, wherein said peroxidases, which may be different or identical, are each chosen from peroxidases of animal origin, plant origin, fungal origin bacterial origin and those peroxidases obtained by biotechnology.

40. A composition according to Claim 39, wherein said peroxidases, which may be identical or different, are each chosen from peroxidases extracted from apples, peroxidases extracted from apricots, peroxidases extracted from barleys, peroxidases extracted from black radishes, peroxidases extracted from beetroots, peroxidases

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extracted from cabbages, peroxidases extracted from carrots, peroxidases extracted from corns, peroxidases extracted from cottons, peroxidases extracted from garlics, peroxidases extracted from grapes, peroxidases extracted from mints, peroxidases extracted from rhubarbs, peroxidases extracted from soybeans, peroxidases extracted from spinach, peroxidases extracted from inky cap, peroxidases extracted from cow's milk and peroxidases extracted from microorganisms.

41. A composition according to Claim 42, wherein said microorganisms are chosen from Acetobacter peroxidans, Staphylococcus faecalis and Arthromycesramosus.

42. A composition according to Claim 1, wherein said peroxidases, which may be different or identical, are present in said composition in an amount ranging from about 0.0001% to about 20% by weight relative to the total weight of said composition.

43. A composition according to Claim 42, wherein said peroxidases, which may be different or identical, are present in said composition in an amount ranging from about 0.001% to about 10% by weight relative to the total weight of said composition.

44. A composition according to Claim 7, wherein said at least one sol-gel reaction further comprises at least one step chosen from addition of at least one cosmetically acceptable organic solvent and dissolving said at least one precursor in at least one cosmetically acceptable organic solvent optionally comprising water.

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45. A composition according to Claim 44, wherein said at least one cosmetically acceptable organic solvent is chosen from lower C_1-C_4 alcohols, propylene glycol, propylene glycol esters, propylene glycolethers, ethylene glycol, ethylene glycol esters, ethylene glycol ethers, acetone, methyl ethyl ketone, methyl acetate, ethyl acetate, butyl acetate, glycerol, volatile hydrocarbon oils, non-volatile hydrocarbon oils, volatile silicones and non-volatile silicones.

46. A composition according to Claim 45, wherein said lower C_1-C_4 alcohols are chosen from ethanol.

47. A composition according to Claim 45, wherein said volatile hydrocarbon oils are chosen from Isopars isoparaffins and isododecane.

48. A composition according to Claim 45, wherein said volatile silicones are chosen from cyclomethicones and hexamethyldisiloxanes.

49. A composition according Claim 1, wherein said at least one oxidation dye is chosen from oxidation bases, couplers and acid addition salts of any of the foregoing.

50. A composition according to Claim 49, wherein said acid addition salts are chosen from hydrochlorides, hydrobromides, sulphates, tartrates, lactates and acetates.

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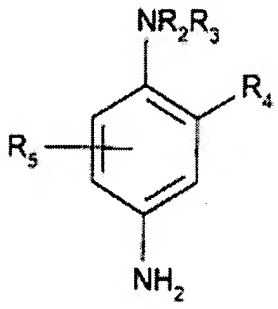
51. A composition according to Claim 49, wherein said oxidation bases are chosen from para-phenylenediamines, double bases, para-aminophenols and heterocyclic bases.

52. A composition according to Claim 51, wherein said para-phenylenediamines are chosen from compounds having formula (IV) and the acid addition salts thereof:



(IV)

wherein:

- R_2 and R_3, which may be identical or different, are each chosen from hydrogen atoms, C_1-C_4 alkyl groups and C_1-C_4 monohydroxyalkyl groups;
- R_4 is chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkyl groups and C_1-C_4 monohydroxyalkyl groups; and
- R_5 is chosen from hydrogen atoms and C_1-C_4 alkylgroups.

53. A composition according to Claim 52, wherein said para-phenylenediamines of formula (IV) are chosen from para-phenylenediamine, para-tolylenediamine, 2-chloro-para-phenylenediamine, 2,3-dimethyl-para-phenylenediamine, 2,6-dimethyl-para-phenylenediamine, 2,6-diethyl-para-phenylenediamine, 2,5-dimethyl-

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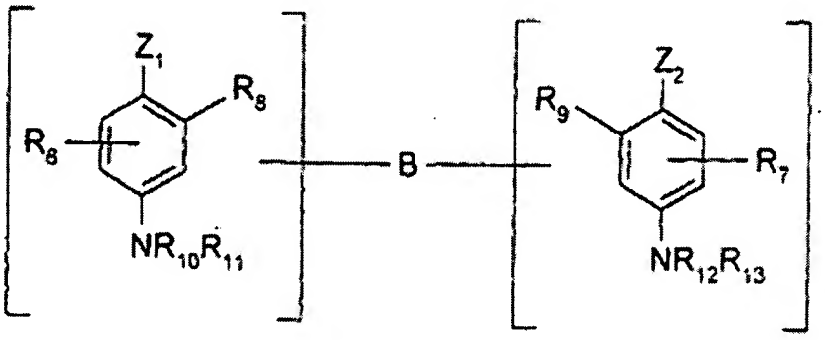
para-phenylenediamine, N,N-dimethyl-para-phenylenediamine, N,N-diethyl-para-phenylenediamine, N,N-dipropyl-para-phenylenediamine, 4-amino-N,N-diethyl-3-methylaniline, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 4-N,N-bis(β-hydroxyethyl)amino-2-methylaniline, 4-N,N-bis(β-hydroxyethyl)amino-2-chloroaniline, 2-β-hydroxyethyl-para-phenylenediamine, 2-fluoro-para-phenylenediamine, 2-isopropyl-para-phenylenediamine, N-(β-hydroxypropyl)-para-phenylenediamine, 2-hydroxymethyl-para-phenylenediamine, N,N-dimethyl-3-methyl-para-phenylenediamine and N-ethyl-N-(β-hydroxyethyl)-para-phenylenediamine.

54. A composition according to Claim 51, wherein said double bases are chosen from compounds of formula (V) and the acid addition salts thereof:



(V)

wherein:

- Z_1 and Z_2, which may be identical or different, are each chosen from hydroxyl groups and $-NH_2$ groups which optionally may be substituted with at least one group chosen from C_1-C_4 alkyl groups and linking arms B;

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- R_6 and R_7, which may be identical or different, are each chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkylgroups, C_1-C_4 monohydroxyalkylgroups, C_2-C_4 polyhydroxyalkylgroups, C_1-C_4 aminoalkylgroups and linking arms B;
- R_8, R_9, R_{10}, R_{11}, R_{12} and R_{13}, which may be identical or different, are each chosen from hydrogen atoms, C_1-C_4 alkylgroups and linking arms B; and
- the linking arms B are chosen from linear and branched, divalent alkylene groups comprising from 1 to 14 carbon atoms, which may optionally be interrupted by and may optionally end with at least one group chosen from nitrogen-containing groups and hetero atoms, and which may optionally be substituted with at least one group chosen from hydroxyl groups and C_1-C_6 alkoxygroups;

with the proviso that said compounds of formula (V) comprise only one linking arm B per molecule.

55. A composition according to Claim 54, wherein said hetero atoms are chosen from oxygen atoms, sulphur atoms and nitrogen atoms.

56. A composition according to Claim 54, wherein said nitrogen-containing groups are chosen from amino groups, mono(C_1-C_4)alkylamino groups, di(C_1-C_4)alkylamino groups, tri(C_1-C_4)alkylamino groups, monohydroxy(C_1-C_4)alkylamino groups, imidazolinium groups and ammonium groups.

57. A composition according to Claim 56, wherein said double bases of formula (V) are chosen from N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)-1,3-

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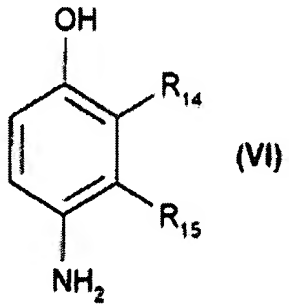
diaminopropanol, N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)ethylenediamine, N,N'-bis(4-aminophenyl)tetramethylenediamine, N,N'-bis(β-hydroxyethyl)-N,N'-bis(4-aminophenyl)tetramethylenediamine, N,N'-bis(4-methylaminophenyl)tetramethylene-diamine, N,N'-bis(ethyl)-N,N'-bis(4'-amino-3'-methylphenyl)ethylenediamine and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane.

58. A composition according to Claim 57, wherein said double bases of formula (V) are chosen from N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)-1,3-diaminopropanol and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane.

59. A composition according to Claim 51, wherein said para-aminophenols are chosen from compounds of formula (VI) and the acid addition salts thereof:



(VI)

wherein:

- R_{14} and R_{15}, which may be identical or different, are each chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkyl groups, C_1-C_4 monohydroxyalkyl groups, (C_1-C_4)alkoxy(C_1-C_4)alkyl groups, C_1-C_4 aminoalkyl groups and monohydroxy(C_1-C_4)alkylamino(C_1-C_4)alkyl groups;

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with the proviso that at least one of said R_{14} and said R_{15} is a hydrogen atom.

60. A composition according to Claim 59, wherein said para-aminophenols of formula (VI) are chosen from para-aminophenol, 4-amino-3-methylphenol, 4-amino-3-fluorophenol, 4-amino-3-hydroxymethylphenol, 4-amino-2-methylphenol, 4-amino-2-hydroxymethylphenol, 4-amino-2-methoxymethylphenol, 4-amino-2-aminomethylphenol, 4-amino-2-(β-hydroxyethylaminomethyl)phenol, and 4-amino-2-fluorophenol.

61. A composition according to Claim 51, wherein said heterocyclic bases are chosen from pyridine derivatives, pyrimidine derivatives and pyrazole derivatives.

62. A composition according to Claim 49, wherein said couplers are chosen from meta-aminophenols, meta-phenylenediamines, meta-diphenols, naphthols and heterocyclic couplers.

63. A composition according to Claim 62, wherein said couplers are chosen from 2-methyl-5-aminophenol, 5-N-(β-hydroxyethyl)amino-2-methylphenol, 3-aminophenol, 1,3-dihydroxybenzene, 1,3-dihydroxy-2-methylbenzene, 4-chloro-1,3-dihydroxybenzene, 2,4-diamino-1-(β-hydroxyethyloxy)benzene, 2-amino-4-(β-hydroxyethylamino)-1-methoxybenzene, 1,3-diaminobenzene, 1,3-bis(2,4-diaminophenoxy)propane, sesamol, 1-amino-2-methoxy-4,5-methylenedioxybenzene, α-naphthol, 2-methyl-1-naphthol, 6-hydroxyindole, 4-hydroxyindole, 4-hydroxy-N-

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methylindole, 6-hydroxyindoline, 2,6-dihydroxy-4-methylpyridine, 1H-3-methylpyrazol-5-one and 1-phenyl-3-methylpyrazol-5-one.

64. A composition according to Claim 1, wherein said at least one oxidation dye is present in said composition in an amount ranging from about 0.001% to about 20% by weight relative to the total weight of said composition.

65. A composition according to Claim 64, wherein oxidation dyes are present in said composition in an amount ranging from about 0.01% to about 10% by weight relative to the total weight of said composition.

66. A composition according Claim 1, further comprising at least one direct dye.

67. A composition according to Claim 1, wherein said medium suitable for said oxidation dyeing is chosen from water and a mixture of water and at least one organic solvent.

68. A composition according to Claim 67, wherein said at least one organic solvent is chosen from C_1-C_4 alkanols, glycerol, glycols, glycol ethers and aromatic alcohols.

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69. A composition according to Claim 68, wherein said glycols and glycol ethers are chosen from 2-butoxyethanol, propylene glycol, propylene glycol monomethyl ether, diethylene glycol monoethyl ether and diethylene glycol monomethyl ether.

70. A composition according to Claim 69, wherein said aromatic alcohols are chosen from benzyl alcohol and phenoxy ethanol.

71. A composition according to Claim 1, wherein said medium suitable for said oxidation dyeing is present in said composition in an amount ranging from 1% to 40% by weight relative to the total weight of said composition.

72. A composition according to Claim 71, wherein said medium suitable for said oxidation dyeing is present in said composition in an amount ranging from about 5% to about 30% by weight relative to the total weight of said composition.

73. A composition according to Claim 1 having a pH ranging from about 3 to about 11.

74. A composition according to Claim 73, wherein said pH ranges from about 4 to about 9.

75. A composition according to Claim 1, further comprising at least one suitable additive chosen from anionic surfactants, cationic surfactants, nonionic

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surfactants, amphoteric surfactants, zwitterionic surfactants, cationic polymer, nonionic polymer, amphoteric polymer, zwitterionic polymers, inorganic thickeners, organic thickeners, antioxidants, penetrating agents, sequestering agents, fragrances, buffers, dispersants, conditioners, film-forming agents, ceramides, preserving agents and opacifiers.

76. A composition according to Claim 1 in the form of a liquid, a cream, a mousse, a gel or in any other form suitable for at least one keratinous fibre.

77. A composition according to Claim 76, wherein said composition form may optionally be pressurized.

78. A composition for oxidation dyeing of keratinous fibres comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases,

wherein said at least one oxidation dye and said at least one enzymatic system are immobilized in at least one sol-gel matrix;

with the proviso that when said at least one enzyme is chosen from 2-electron

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oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme; and

with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ;

in a medium suitable said oxidation dyeing.

79. A process for oxidation dyeing of at least one keratinous fibre comprising applying to said at least one keratinous fibre for a time and at a temperature sufficient to achieve a desired coloration, at least one composition comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one enzyme immobilized in at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases;

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme, and

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with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ,

in a medium suitable said oxidation dyeing.

80. A process according to Claim 79, wherein said at least one composition is a ready-to-use composition.

81. A process according to Claim 79, further comprising the step of rinsing said composition from said fibres.

82. A process according to Claim 81, further comprising the step of washing the fibres.

83. A process according to Claim 82, further comprising the step of rinsing said fibres a second time.

84. A process according to Claim 83, further comprising the step of drying said fibres.

85. A process according to Claim 79, wherein said time sufficient to achieve a desired colouration ranges from about 1 to about 60 minutes.

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86. A process according to Claim 85, wherein said time sufficient to achieve a desired colouration ranges from about 5 to about 30 minutes.

87. A process according to Claim 79, wherein said temperature sufficient to achieve a desired colouration ranges from room temperature to about 60°C.

88. A process according to Claim 87, wherein said temperature sufficient to achieve a desired colouration ranges from room temperature to about 45°C.

89. A process according to Claim 88, wherein said temperature sufficient to achieve a desired colouration ranges from about 20°C to about 37°C.

90. A process according to Claim 79, wherein said at least one keratinous fibre is a human keratinous fibre.

91. A process according to Claim 90, wherein said human keratinous fibre is hair.

92. A process according to Claim 79, wherein said at least one composition is chosen from ready-to-use compositions.

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93. A process according to Claim 79, wherein said at least one oxidation dye and said at least one enzymatic system are immobilized in the at least one sol-gel matrix.

94. A process according to Claim 79, wherein said at least one enzyme is chosen from 4-electron oxidoreductases and said at least one enzyme is combined with said at least one oxidation dye.

95. A process according to Claim 79, wherein said sol-gel matrix is derived from at least one sol-gel reaction of at least one precursor at a temperature suitable for said at least one sol-gel reaction, said at least one sol-gel reaction comprising (i) at least one hydrolysis reaction chosen from partial and total, acidic and basic hydrolysis reactions, and (ii) at least one condensation reaction.

96. A process according to Claim 95, wherein said temperature suitable for said at least one sol-gel reaction ranges from about 10°C to about 85°C.

97. A process according to Claim 96, wherein said temperature suitable for said at least one sol-gel reaction ranges from about 20°C to about 40°C.

98. A process according to Claim 95, wherein said at least one precursor is chosen from metallic precursors wherein said metallic precursors are chosen from:

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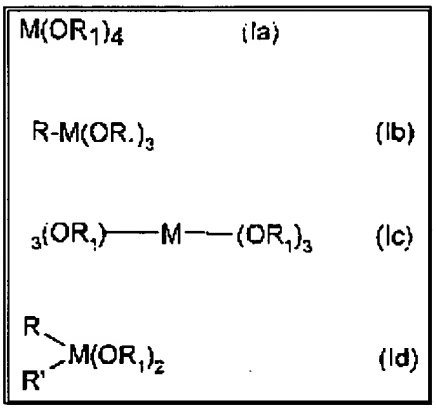
(i) oxides of transition metals, wherein said oxides of transition metals are chosen from oxides of transition metals of groups 1b to 7b of the Periodic Table, oxides of transition metals of group 8 and oxides of transition metals of the Lanthanide group of the Periodic Table;

(ii) aluminum oxides, boron oxides, silicon oxides and tin oxides; and

(iii) aluminum phosphates.

99. A process according to Claim 95, wherein said at least one precursor is chosen from organometallic precursors, wherein said organometallic precursors are chosen from:

(1) silanes, titanates, and zirconates of formulae (Ia), (Ib), (Ic) and (Id):



wherein:

- M is chosen from silicon cations, titanium cations and zirconium cations;

- R_1 is chosen from linear and branched alkyl groups;

- R and R', which may be identical or different, are each chosen from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said groups may optionally be substituted

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with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

(2) chelated titanates of formula (II) and chelated zirconates of formula (II):

N(OR1)n(X)x (II)

wherein:

- N is chosen from Ti^{a+} and Zr^{a+},

wherein:

- a is chosen from 4 and 6;

- X, which may be identical or different, are each chosen from chelating groups,

wherein:

- the degree of complexation of said chelating groups with said N is b;

wherein:

- b is chosen from 2 and 3;

- R_1, which may be identical or different, are each chosen from linear and branched alkyl groups;

- x is 1 or 2; and

- n is equal to (a-bx), with the proviso that n is greater than or equal to 1; and

(3) chelated titanates of formulae (IIIa), (IIIb) and (IIIc) and chelated zirconates of formulae (IIIa), (IIIb) and (IIIc):

$R\text{-}N(OR_1)_m(X)_t$ (IIIa)

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$(X)_t(R_1O)_mN\text{-}R''\text{-}N(OR_1)_m(X)_t$ (IIIb)

$(R)(R')N(OR_1)_p(X)_t$ (IIIc)

wherein:

- N is chosen from Ti^{a+} and Zr^{a+}, wherein a is chosen from 4 and 6;

- X, which may be identical or different, are each chosen from chelating groups,

wherein:

- the degree of complexation of said chelating groups with said N is b, wherein b is chosen from 2 and 3;

- R_1, which may be identical or different, are each chosen from linear and branched alkyl groups;

- R and R', which may be identical or different, are each chosen from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said groups may optionally be substituted with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

- R" is a divalent group derived from linear and branched C_1-C_{30} alkyl groups, C_3-C_{30} cycloalkyl groups, aryl groups, C_4-C_{30} aralkyl groups and C_4-C_{30} alkylaryl groups, wherein said divalent group may optionally be substituted with at least one group chosen from amino groups, carboxyl groups and hydroxyl groups;

- t is chosen from 1 and 2, except in IIIc, t may only be 1;

- m is equal to (a-bt-1), with the proviso that m is greater than or equal to 1; and

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- p is equal to (a-bt-2), with the proviso that p is greater than or equal to 1.

100. A process according to Claim 99, wherein said R_1 is chosen from linear and branched C_1-C_4 alkyl groups.

101. A process according to Claim 99, wherein said chelating groups are chosen from carboxylic acids, β-ketones, β-diketones, β-keto esters, β-keto amines, α-hydroxy acids, β-hydroxy acids, amino acids, salicylic acid and derivatives of any of the foregoing.

102. A process according to Claim 101, wherein said chelating groups are chosen from acetoacetoxyethyl methacrylate, methyl α-hydroxymethacrylate, ϵ-N-methacryloyl-L-lysine, 4- ethacrylaminosalicylic acid and 5-methacrylaminosalicylic acid.

103. A process according to Claim 95, wherein said at least one precursor is chosen from tetraalkoxysilanes, alkyltrialkoxysilanes and aminoalkyltrialkoxysilanes.

104. A process according to Claim 95, wherein said at least one sol-gel matrix further comprises at least one additional optionally functionalized polymer.

105. A process according to Claim 104, wherein said at least one sol-gel matrix comprises at least one polymer network, chosen from partially crosslinked polymer

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networks and totally crosslinked polymer networks, derived from said at least one sol-gel reaction of said at least one precursor and at least one additional optionally functionalized polymer.

106. A process according to Claim 105, wherein said at least one additional optionally functionalized polymer is chosen from polymers derived from radical polymerization of at least one monomer and polymers derived from polycondensation of at least one monomer.

107. A process according to Claim 79, wherein said 2-electron oxidoreductases, which may be identical or different, are each chosen from pyranose oxidases, glucose oxidases, glycerol oxidases, lactate oxidases, pyruvate oxidases, uricases, choline oxidases, sarcosine oxidases, bilirubin oxidases and amino acid oxidases.

108. A process according to Claim 107, wherein said uricases are chosen from uricases of animal origin, microbial origin and those uricases derived from biotechnology.

109. A process according to Claim 107, wherein said uricases are chosen from uricases extracted from boar's liver, uricases derived from Arthrobacter globiformis and uricases derived from Aspergillus flavus.

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110. A process according to Claim 79, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 0.01% to about 20% by weight relative to the total weight of said composition.

111. A process according to Claim 110, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 0.1% to about 10% by weight relative to the total weight of said composition.

112. A process according to Claim 79, wherein said 2-electron oxidoreductases, which may be identical or different, are present in said composition in an amount ranging from about 10 U to about 10^8 U units per 100 g of dye composition.

113. A process according Claim 79, wherein said 4-electron oxidoreductases, which may be identical or different, are chosen from laccases, tyrosinases, catechol oxidases, deamino oxidases and polyphenol oxidases.

114. A process according to Claim 113, wherein said 4-electron oxidoreductases, which may be identical or different, are each chosen from laccases of plant origin, animal origin, fungal origin and bacterial origin and laccases obtained by biotechnology.

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115. A process according to Claim 114, wherein said laccases are chosen from those produced by plants performing chlorophyll synthesis.

116. A process according to Claim 114, wherein said laccases are chosen from any of the laccases which may be extracted from Anacardiacea, Podocarpacea, Rosmarinus off., Solanum tuberosum, Iris sp., Coffea sp., Daucus carrota, Vinca minor, Persea americana, Catharanthus roseus, Musa sp., Malus pumila, Gingko biloba, Monotropa hypopithys , Aesculus sp., Acer pseudoplatanus, Prunus persica and Pistacia palaestina.

117. A process according to Claim 114, wherein said laccases are chosen from those of fungal origin and those obtained by biotechnology.

118. A process according to Claim 117, wherein said laccases are chosen from Polyporus versicolor, Rhizoctonia praticola, Rhus vernicifera, Scytalidium, Polyporus pinsitus, Myceliophthora thermophila, Rhizoctonia solani, Pyricularia orizae, Trametes versicolor, Fomes fomentarius, Chaetomium thermophile, Neurospora crassa, Colorius versicol, Botrytis cinerea, Rigidoporus lignosus, Phellinus noxius, Pleurotus ostreatus, Aspergillus nidulans, Podospora anserina, Agaricus bisporus, Ganoderma lucidum, Glomerella cingulata, Lactarius piperatus, Russula delica, Heterobasidion annosum, Thelephora terrestris, Cladosporium cladosporioides, Cerrena unicolor, Coriolus hirsutus, Ceriporiopsis subvermispora, Coprinus cinereus, Panaeolus papilionaceus,

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Panaeolus sphinctrinus, Schizophyllum commune, Dichomitius squalens and variants of any of the foregoing.

119. A process according to Claim 114, wherein said laccases are present in said composition in an amount ranging from about 0.5 lacu to 2000 lacu units per 100 g of said composition.

120. A process according to Claim 114, wherein said laccases are present in said composition in an amount ranging from about 10,000 U to about $4x10^7$ U units per 100 g of said composition.

121. A process according to Claim 114, wherein said laccases are present in said composition in an amount ranging from about 20 ulac to about $2x10^6$ ulac units per 100 g of said composition.

122. A process according to Claim 79, wherein said 4-electron oxidoreductases are present in said composition in an amount ranging from about 0.01% to about 20% by weight relative to the total weight of said composition.

123. A process according to Claim 122, wherein said 4-electron oxidoreductases are present in said composition in an amount ranging from about 0.1% to about 10% by weight relative to the total weight of said composition.

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124. A process according Claim 79, wherein said peroxidases, which may be identical or different, are each chosen from NADH peroxidases, fatty acid peroxidases, NADPH peroxidases, cytochrome-c peroxidases, iodide peroxidases, chloride peroxidases, L-ascorbate peroxidases and glutathione peroxidases.

125. A process according to Claim 79, wherein said peroxidases, which may be identical or different, are each chosen from simplex peroxidases and catalases.

126. A process according to Claim 125, wherein said peroxidases, which may be identical or different, are each chosen from simplex peroxidases.

127. A process according to Claim 79, wherein said peroxidases, which may be different or identical, are each chosen from peroxidases of animal origin, plant origin, fungal origin bacterial origin and those peroxidases obtained by biotechnology.

128. A process according to Claim 127, wherein said peroxidases, which may be identical or different, are each chosen from peroxidases extracted from apples, peroxidases extracted from apricots, peroxidases extracted from barleys, peroxidases extracted from black radishes, peroxidases extracted from beetroots, peroxidases extracted from cabbages, peroxidases extracted from carrots, peroxidases extracted from corns, peroxidases extracted from cottons, peroxidases extracted from garlics, peroxidases extracted from grapes, peroxidases extracted from mints, peroxidases extracted from rhubarbs, peroxidases extracted from soybeans, peroxidases extracted

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from spinach, peroxidases extracted from inky cap, peroxidases extracted from cow's milk and peroxidases extracted from microorganisms.

129. A process according to Claim 79, wherein said peroxidases, which may be different or identical, are present in said composition in an amount ranging from about 0.0001% to about 20% by weight relative to the total weight of said composition.

130. A process according to Claim 129, wherein said peroxidases, which may be different or identical, are present in said composition in an amount ranging from about 0.001% to about 10% by weight relative to the total weight of said composition.

131. A process according to Claim 95, wherein said at least one sol-gel reaction further comprises at least one step chosen from addition of at least one cosmetically acceptable organic solvent and dissolving said at least one precursor in at least one cosmetically acceptable organic solvent optionally comprising water.

132. A process according to Claim 131, wherein said at least one cosmetically acceptable organic solvent is chosen from lower C_1-C_4 alcohols, propylene glycol, propylene glycol esters, propylene glycolethers, ethylene glycol, ethylene glycol esters, ethylene glycol ethers, acetone, methyl ethyl ketone, methyl acetate, ethyl acetate, butyl acetate, glycerol, volatile hydrocarbon oils, non-volatile hydrocarbon oils, volatile silicones and non-volatile silicones.

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133. A process according to Claim 132, wherein said lower C_1-C_4 alcohols are chosen from ethanol.

134. A process according to Claim 132, wherein said volatile hydrocarbon oils are chosen from Isopars isoparaffins and isododecane.

135. A process according to Claim 132, wherein said volatile silicones are chosen from cyclomethicones and hexamethyldisiloxanes.

136. A process according Claim 79, wherein said at least one oxidation dye is chosen from oxidation bases, couplers and acid addition salts of any of the foregoing.

137. A process according to Claim 136, wherein said acid addition salts are chosen from hydrochlorides, hydrobromides, sulphates, tartrates, lactates and acetates.

138. A process according to Claim 136, wherein said oxidation bases are chosen from para-phenylenediamines, double bases, para-aminophenols and heterocyclic bases.

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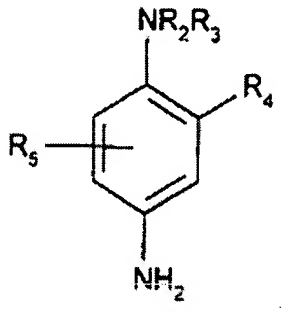
139. A process according to Claim 138, wherein said para-phenylenediamines are chosen from compounds having formula (IV) and the acid addition salts thereof:



(IV)

wherein:

- R_2 and R_3, which may be identical or different, are each chosen from hydrogen atoms, C_1-C_4 alkyl groups and C_1-C_4 monohydroxyalkyl groups;
- R_4 is chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkyl groups and C_1-C_4 monohydroxyalkyl groups; and
- R_5 is chosen from hydrogen atoms and C_1-C_4 alkylgroups.

140. A process according to Claim 139, wherein said para-phenylenediamines of formula (IV) are chosen from para-phenylenediamine, para-tolylenediamine, 2-chloro-para-phenylenediamine, 2,3-dimethyl-para-phenylenediamine, 2,6-dimethyl-para-phenylenediamine, 2,6-diethyl-para-phenylenediamine, 2,5-dimethyl-para-phenylenediamine, N,N-dimethyl-para-phenylenediamine, N,N-diethyl-para-phenylenediamine, N,N-dipropyl-para-phenylenediamine, 4-amino-N,N-diethyl-3-methylaniline, N,N-bis(β-hydroxyethyl)-para-phenylenediamine, 4-N,N-bis(β-

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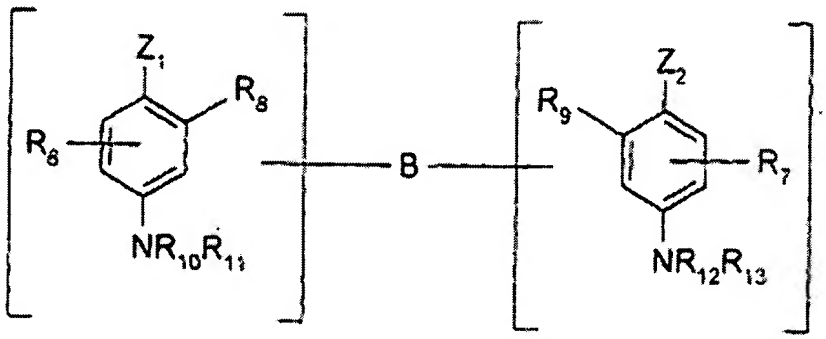
hydroxyethyl)amino-2-methylaniline, 4-N,N-bis(β-hydroxyethyl)amino-2-chloroaniline, 2-β-hydroxyethyl-para-phenylenediamine, 2-fluoro-para-phenylenediamine, 2-isopropyl-para-phenylenediamine, N-(β-hydroxypropyl)-para-phenylenediamine, 2-hydroxymethyl-para-phenylenediamine, N,N-dimethyl-3-methyl-para-phenylenediamine and N-ethyl-N-(β-hydroxyethyl)-para-phenylenediamine.

141. A process according to Claim 138, wherein said double bases are chosen from compounds of formula (V) and the acid addition salts thereof:



(V)

wherein:

- Z_1 and Z_2, which may be identical or different, are each chosen from hydroxyl groups and $-NH_2$ groups which optionally may be substituted with at least one group chosen from C_1-C_4 alkyl groups and linking arms B;
- R_6 and R_7, which may be identical or different, are each chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkylgroups, C_1-C_4 monohydroxyalkylgroups, C_2-C_4 polyhydroxyalkylgroups, C_1-C_4 aminoalkylgroups and linking arms B;
- R_8, R_9, R_{10}, R_{11}, R_{12} and R_{13}, which may be identical or different, are each chosen from hydrogen atoms, C_1-C_4 alkylgroups and linking arms B; and

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- the linking arms B are chosen from linear and branched, divalent alkylene groups comprising from 1 to 14 carbon atoms, which may optionally be interrupted by and may optionally end with at least one group chosen from nitrogen-containing groups and hetero atoms, and which may optionally be substituted with at least one group chosen from hydroxyl groups and C_1-C_6 alkoxygroups;

with the proviso that said compounds of formula (V) comprise only one linking arm B per molecule.

142. A process according to Claim 141, wherein said hetero atoms are chosen from oxygen atoms, sulphur atoms and nitrogen atoms.

143. A process according to Claim 141, wherein said nitrogen-containing groups are chosen from amino groups, mono(C_1-C_4)alkylamino groups, di(C_1-C_4)alkylamino groups, tri(C_1-C_4)alkylamino groups, monohydroxy(C_1-C_4)alkylamino groups, imidazolinium groups and ammonium groups.

144. A process according to Claim 143, wherein said double bases of formula (V) are chosen from N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)-1,3-diaminopropanol, N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)ethylenediamine, N,N'-bis(4-aminophenyl)tetramethylenediamine, N,N'-bis(β-hydroxyethyl)-N,N'-bis(4-aminophenyl)tetramethylenediamine, N,N'-bis(4-methylaminophenyl)tetramethylene-diamine, N,N'-bis(ethyl)-N,N'-bis(4'-amino-3'-methylphenyl)ethylenediamine and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane.

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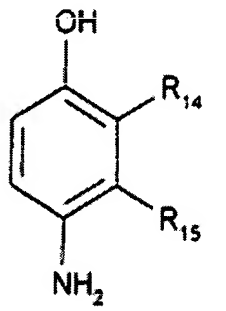
145. A process according to Claim 144, wherein said double bases of formula (V) are chosen from N,N'-bis(β-hydroxyethyl)-N,N'-bis(4'-aminophenyl)-1,3-diaminopropanol and 1,8-bis(2,5-diaminophenoxy)-3,5-dioxaoctane.

146. A process according to Claim 138, wherein said para-aminophenols are chosen from compounds of formula (VI) and the acid addition salts thereof:



(VI)

wherein:

- R_{14} and R_{15}, which may be identical or different, are each chosen from hydrogen atoms, halogen atoms, C_1-C_4 alkyl groups, C_1-C_4 monohydroxyalkyl groups, (C_1-C_4)alkoxy(C_1-C_4)alkyl groups, C_1-C_4 aminoalkyl groups and monohydroxy(C_1-C_4)alkylamino(C_1-C_4)alkyl groups;

with the proviso that at least one of said R_{14} and said R_{15} is a hydrogen atom.

147. A process according to Claim 146, wherein said para-aminophenols of formula (VI) are chosen from para-aminophenol, 4-amino-3-methylphenol, 4-amino-3-fluorophenol, 4-amino-3-hydroxymethylphenol, 4-amino-2-methylphenol, 4-amino-2-

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hydroxymethylphenol, 4-amino-2-methoxymethylphenol, 4-amino-2-aminomethylphenol, 4-amino-2-(β-hydroxyethylaminomethyl)phenol, and 4-amino-2-fluorophenol.

148. A process according to Claim 138, wherein said heterocyclic bases are chosen from pyridine derivatives, pyrimidine derivatives and pyrazole derivatives.

149. A process according to Claim 136, wherein said couplers are chosen from meta-aminophenols, meta-phenylenediamines, meta-diphenols, naphthols and heterocyclic couplers.

150. A process according to Claim 149, wherein said couplers are chosen from 2-methyl-5-aminophenol, 5-N-(β-hydroxyethyl)amino-2-methylphenol, 3-aminophenol, 1,3-dihydroxybenzene, 1,3-dihydroxy-2-methylbenzene, 4-chloro-1,3-dihydroxy-benzene, 2,4-diamino-1-(β-hydroxyethyloxy)benzene, 2-amino-4-(β-hydroxyethylamino)-1-methoxybenzene, 1,3-diaminobenzene, 1,3-bis(2,4-diaminophenoxy)propane, sesamol, 1-amino-2-methoxy-4,5-methylenedioxybenzene, α-naphthol, 2-methyl-1-naphthol, 6-hydroxyindole, 4-hydroxyindole, 4-hydroxy-N-methylindole, 6-hydroxyindoline, 2,6-dihydroxy-4-methylpyridine, 1H-3-methylpyrazol-5-one and 1-phenyl-3-methylpyrazol-5-one.

151. A process according to Claim 79, wherein said at least one oxidation dye is present in said composition in an amount ranging from about 0.001% to about 20% by weight relative to the total weight of said composition.

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152. A process according to Claim 151, wherein oxidation dyes are present in said composition in an amount ranging from about 0.01% to about 10% by weight relative to the total weight of said composition.

153. A process according Claim 79, further comprising at least one direct dye.

154. A process according to Claim 79, wherein said medium suitable for at least one keratinous fibre is chosen from water and a mixture of water and at least one organic solvent.

155. A process according to Claim 154, wherein said at least one organic solvent is chosen from C_1-C_4 alkanols, glycerol, glycols, glycol ethers and aromatic alcohols.

156. A process according to Claim 155, wherein said glycols and glycol ethers are chosen from 2-butoxyethanol, propylene glycol, propylene glycol monomethyl ether, diethylene glycol monoethyl ether and diethylene glycol monomethyl ether.

157. A process according to Claim 156, wherein said aromatic alcohols are chosen from benzyl alcohol and phenoxy ethanol.

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158. A process according to Claim 79, wherein said medium suitable for at least one keratinous fibre is present in said composition in an amount ranging from about 1% to about 40% by weight relative to the total weight of said composition.

159. A process according to Claim 158, wherein said medium appropriate for keratinous fibres is present in said composition in an amount ranging from about 5% to about 30% by weight relative to the total weight of said composition.

160. A process according to Claim 79, wherein said composition has a pH ranging from about 3 to about 11.

161. A process according to Claim 160, wherein said pH ranges from about 4 to about 9.

162. A process according to Claim 79, wherein said composition further comprises at least one suitable additive chosen from anionic surfactants, cationic surfactants, nonionic surfactants, amphoteric surfactants, zwitterionic surfactants, cationic polymer, nonionic polymer, amphoteric polymer, zwitterionic polymers, inorganic thickeners, organic thickeners, antioxidants, penetrating agents, sequestering agents, fragrances, buffers, dispersants, conditioners, film-forming agents, ceramides, preserving agents and opacifiers.

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163. A process according to Claim 79, wherein said composition is in the form of a liquid, a cream, a mousse, a gel or in any other form suitable for at least one keratinous fibre.

164. A process according to Claim 163, wherein said composition form may optionally be pressurized.

165. A process for oxidation dyeing of keratinous fibres

comprising applying to said keratinous fibres for a time and at a temperature sufficient to achieve a desired coloration, at least one composition comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one enzyme and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases,

wherein said at least one oxidation dye and said at least one enzymatic system are immobilized in at least one sol-gel matrix;

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme; and

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with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ;

in a medium suitable for said oxidation dyeing.

166. A process for dyeing keratinous fibres comprising:

(a) storing, in the absence of air, at least one composition comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases;

in a medium suitable for said oxidation dyeing,

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme, and

with the proviso that when said at least one enzyme is chosen from peroxidases, said at least oneenzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at

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least one enzymatic system which generates hydrogen peroxide in situ; and

(b) applying said at least one composition to said keratinous fibres in the presence of air and for a time and at a temperature sufficient to develop a desired coloration.

167. A process according to Claim 166, wherein said temperature sufficient to develop a desired coloration ranges from room temperature to about 45°C.

168. A process according to Claim 166, wherein said time sufficient to develop a desired coloration ranges from about 1 to about 60 minutes.

169. A process according to Claim 166, wherein said time sufficient to develop a desired coloration ranges from about 5 to about 30 minutes.

170. A process according to Claim 166, wherein said at least one keratinous fibre is a human keratinous fibre.

171. A process according to Claim 170, wherein said human keratinous fibre is hair.

172. A process for dyeing at least one keratinous fibre comprising:

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(a) storing, in the absence of air, at least one sol-gel matrix comprising at least one composition comprising:

(a) at least one oxidation dye; and

(b) at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases;

(ii) 4-electron oxidoreductases; and

(iii) peroxidases;

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme, and

with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ;

(b) dispersing said at least one sol-gel matrix in a medium suitable for at least one keratinous fibre; and

(c) applying said at least one sol-gel matrix dispersed in said medium suitable for at least one keratinous fibre to said at least one keratinous fibre in the presence of air and for a time and at a temperature sufficient to develop a desired coloration.

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173. A process for dyeing at least one keratinous fibre comprising:

(a) storing a first composition;

(b) storing a second composition separately from said first composition and said third composition;

(c) optionally storing a third composition separately from said first composition and said second composition;

(d) mixing said first composition, said second composition and optionally said third composition to form a mixture in the presence of air; and

(e) applying said mixture to said keratinous fibres for a time and at a temperature sufficient to develop a desired coloration.

174. A multicompartment device or dyeing kit comprising:

(a) a first compartment comprising a first composition; and

(b) a second compartment comprising a second composition;

wherein said first compartment comprises at least one oxidation dye in a medium suitable for said oxidation dyeing and optionally at least one suitable donor for said peroxidases, and

wherein said second compartment comprises at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix and optionally (ii) at least one donor for said at least one enzyme, wherein said at least one enzyme is chosen from:

(i) 2-electron oxidoreductases ;

(ii) 4-electron oxidoreductases; and

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(ii) peroxidases;

in a medium suitable for said oxidation dyeing,

with the proviso that when said at least one enzyme is chosen from 2-electron oxidoreductases, said at least one enzymatic system comprises at least one donor for said at least one enzyme, and

with the proviso that when said at least one enzyme is chosen from peroxidases, said at least one enzymatic system further comprises at least one source of hydrogen peroxide chosen from hydrogen peroxide and at least one enzymatic system which generates hydrogen peroxide in situ, in a medium suitable for said oxidation dyeing.

175. A multicompartment device or dyeing kit comprising:

(a) a first compartment comprising a first composition;

(b) a second compartment comprising a second composition; and

(c) a third compartment comprising a third composition;

wherein said first compartment comprises at least one oxidation dye in a medium suitable for said oxidation dyeing,

wherein said second compartment comprises at least one enzymatic system comprising (i) at least one sol-gel matrix and at least one enzyme immobilized in said at least one sol-gel matrix chosen from 2-electron oxidoreductases and (ii) hydrogen peroxide or at least one enzymatic system which generates hydrogen peroxide in situ, in a medium suitable for said oxidation dyeing , and

wherein said third compartment comprises at least one donor for said at least one enzyme for said at least one enzyme.

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176. A multicompartment device or dyeing kit comprising:

(a) a first compartment comprising a first composition;

(b) a second compartment comprising a second composition; and

(c) a third compartment comprising a third composition;

wherein said second compartment comprises at least one enzymatic system comprising at least one 2-electron oxidoreductase immobilized in at least one sol-gel matrix, at least one peroxidase immobilized in at least one sol-gel matrix and optionally at least one suitable donor, in a medium suitable for said oxidation dyeing and

wherein said third compartment comprises at least one donor for at least one enzyme chosen from 2-electron oxidoreductase donors and peroxidase donors, in a medium suitable for said oxidation dyeing wherein said first compartment comprises at least one oxidation dye and optionally at least one donor for said at least one enzyme, in a medium suitable for said oxidation dyeing.

177. A multicompartment device or dyeing kit comprising:

(a) a first compartment comprising a first composition;

(b) a second compartment comprising a second composition; and

(c) a third compartment comprising a third composition;

wherein said first compartment comprises at least one oxidation dye and optionally at least one suitable donor, in a medium suitable for said oxidation dyeing,

wherein said second compartment comprises at least one sol-gel matrix and at least one enzymatic system comprising at least one peroxidase immobilized in said at

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least one sol-gel matrix and optionally at least one donor for said at least one peroxidase, in a medium suitable for said oxidation dyeing, and

wherein said third compartment comprises at least one source of hydrogen peroxide in a medium suitable for said oxidation dyeing.

178. A multicompartment device or dyeing kit according to claim 177, wherein said at least one source of hydrogen peroxide is chosen from (i) 2-electron oxidoreductases immobilized in at least one sol-gel matrix and at least one donor for said 2-electron oxidoreductases and (ii) hydrogen peroxide solutions.

179. A process according to Claim 127, wherein said microorganisms are chosen from Acetobacter peroxidans, Staphylococcus faecalis and Arthromycesramosus.

180. A composition according to claim 13, wherein said chelating groups are chosen from β-hydroxyamino acids.

181. A process according to claim 101, wherein said chelating groups are chosen from β-hydroxyamino acids.

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